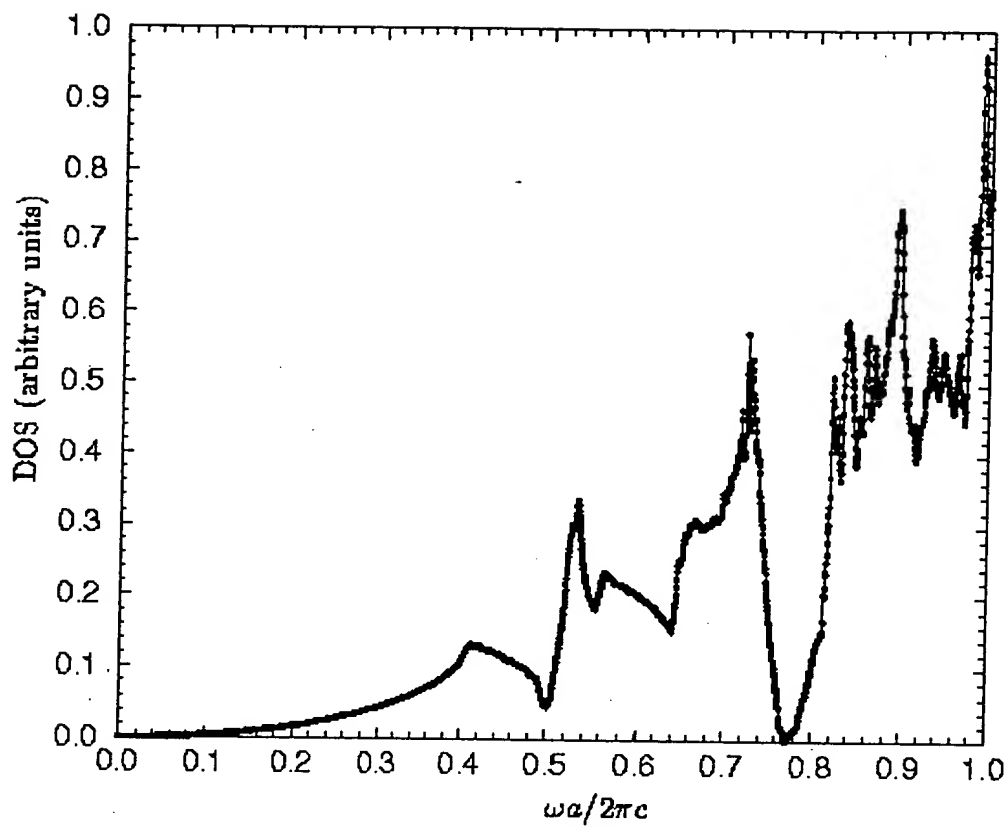
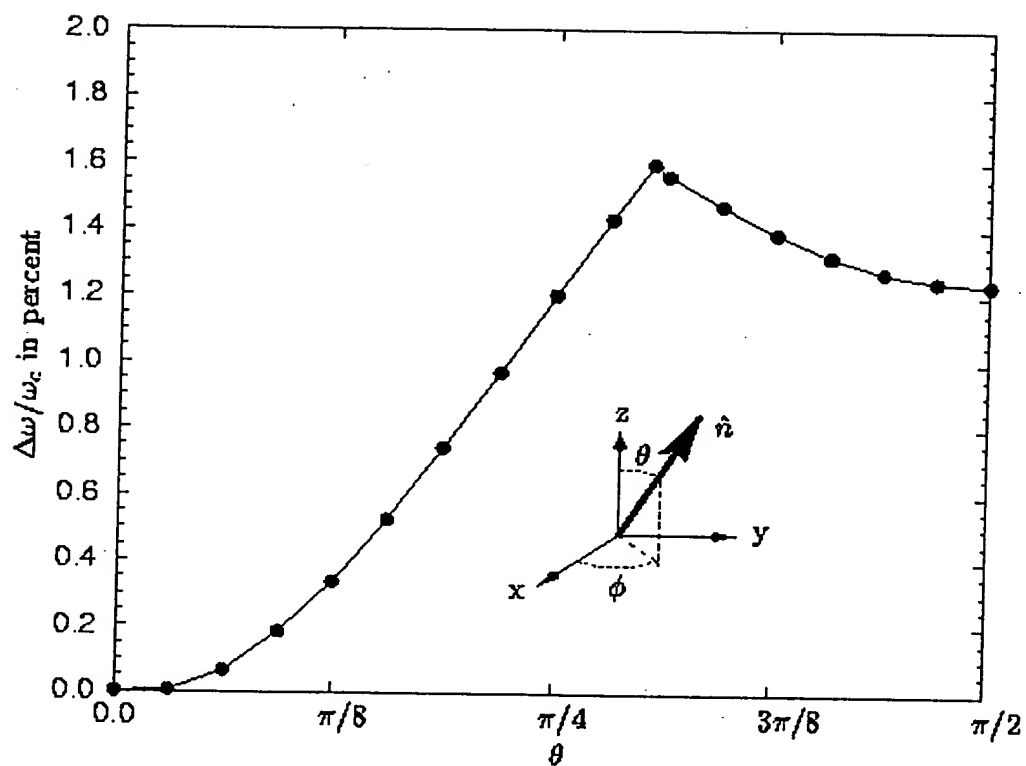


**Figure 1:**

Cross-sectional view through the inverse opal backbone (blue) resulting from incomplete infiltration of silicon into the air voids of an artificial opal. After etching out the template, a fcc lattice of overlapping air spheres remain and additional air voids appear as triangular or diamond shaped holes on the surface of the cut. A tunable PBG is obtained by infiltrating this backbone with nematic liquid crystal (yellow) which wets the inner surface of each sphere (only one is shown in the figure).



**Figure 2:** Total DOS for an inverse opal which is infiltrated with a nematic liquid crystal. The nematic director is orientated along the (0,0,1) axis of the inverse opal backbone. The inverse opal backbone is made of silicon (24.5% by volume) which is infiltrated with the liquid crystal BEHA (36.8% by volume). The isotropic refractive index of silicon is  $n_{Si}=3.4$  and the principal refractive indices of BEHA are  $n_{LC}^{\parallel}=1.6$  and  $n_{LC}^{\perp}=1.4$ .



**Figure 3:** Dependence of the photonic band gap size for a silicon inverted opal infiltrated with the nematic liquid crystal (BEHA) on the orientation of the nematic director  $\hat{n}(\phi, \theta)$  for fixed angle  $\phi = \pi/4$ . The volume fractions are the same as in Fig. 2.

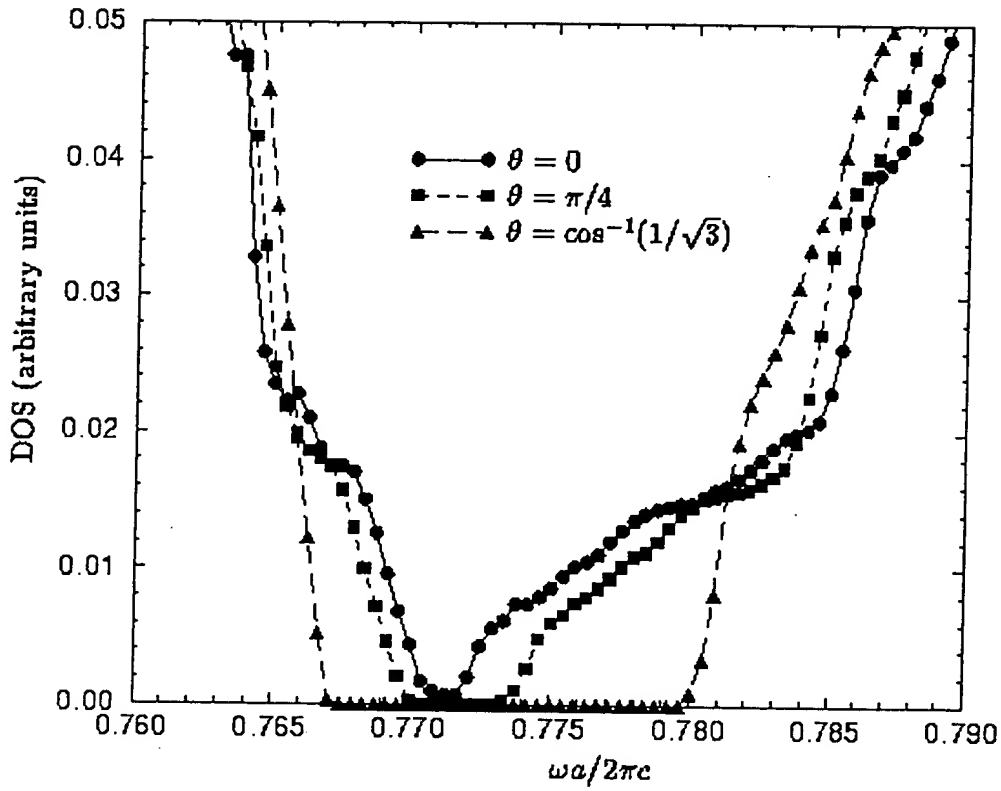


Figure 4: Total photon DOS for a silicon inverse opal which is infiltrated with the nematic liquid crystal (BEHA) for various orientations of the nematic director  $\hat{n}(\phi, \vartheta)$ . The angle  $\phi = \pi/4$  is fixed and the volume fractions are the same as in Fig. 2. The PBG is closed for  $\vartheta = 0$  but reaches a maximum value  $\Delta\omega/\omega_c \approx 1.6\%$  relative to its center frequency  $\omega_c$  for  $\hat{n} = (1,1,1)/\sqrt{3}$ .

FOE2240" 866600660

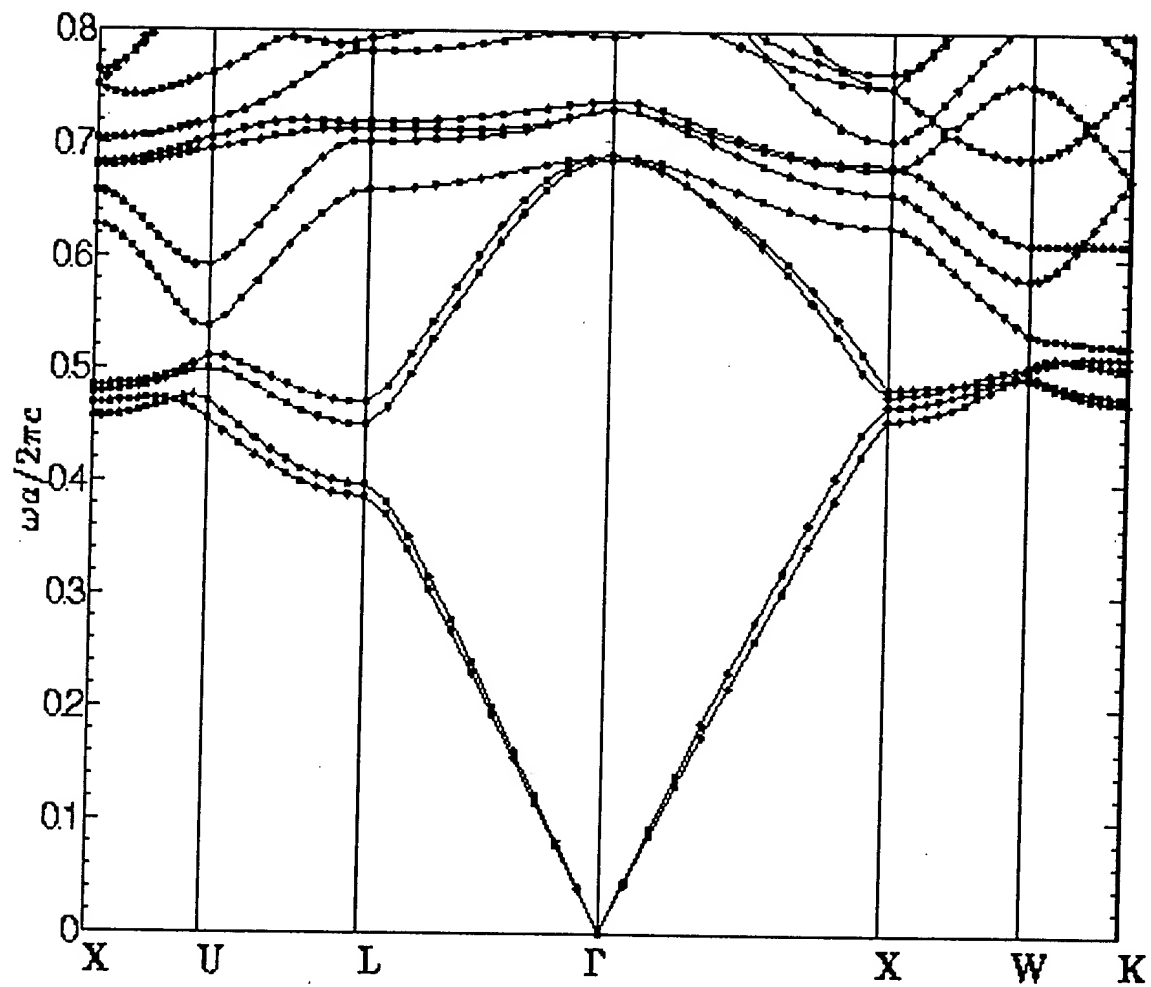


Figure 5. Photonic band structure of a silicon inverse opal which has been fully infiltrated with liquid crystal BEHA

105220-86660660

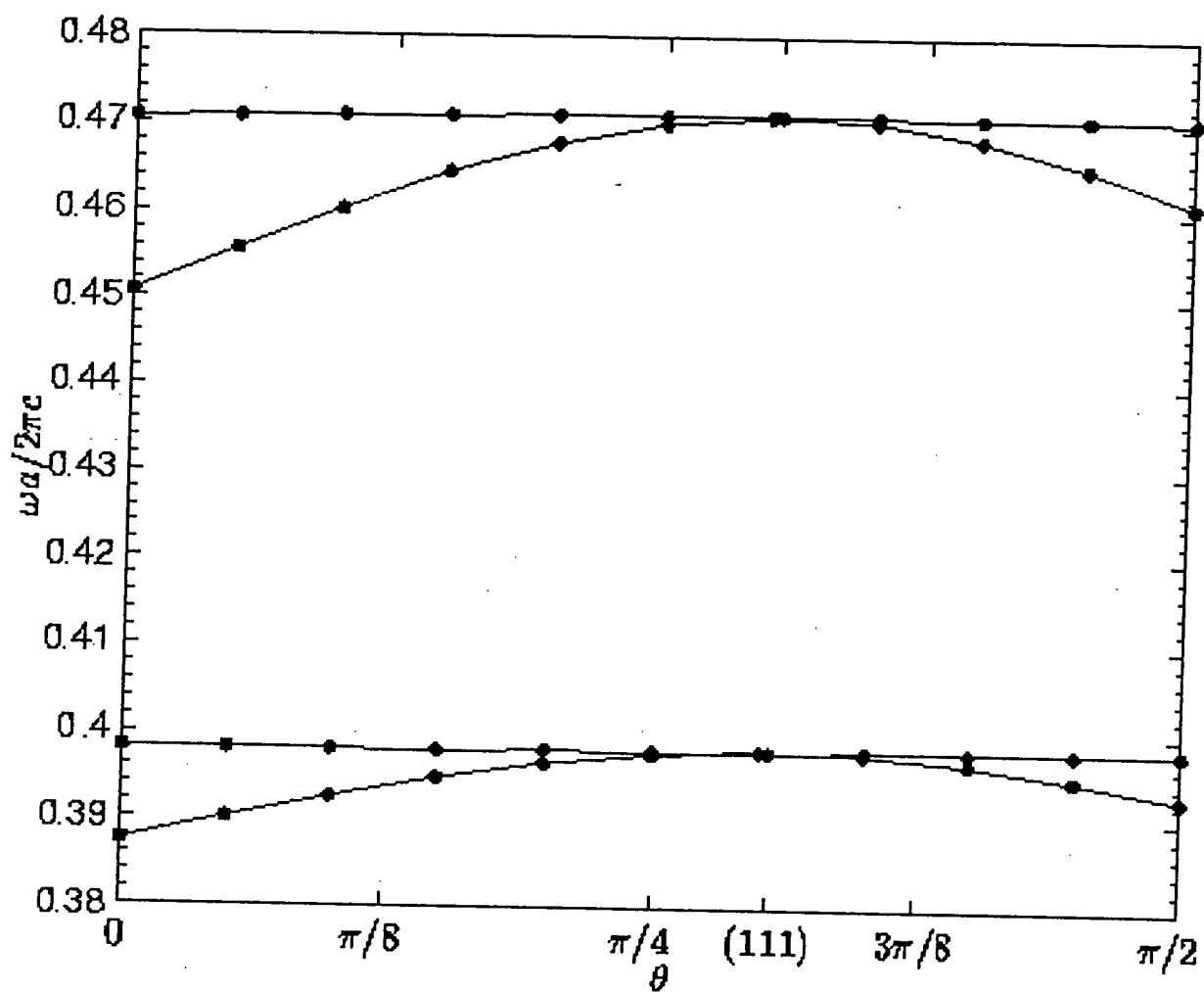


Fig 6. Variation at the L-point: Bands 1-4

Figure 7: Variation at the L-point: Bands 6-10

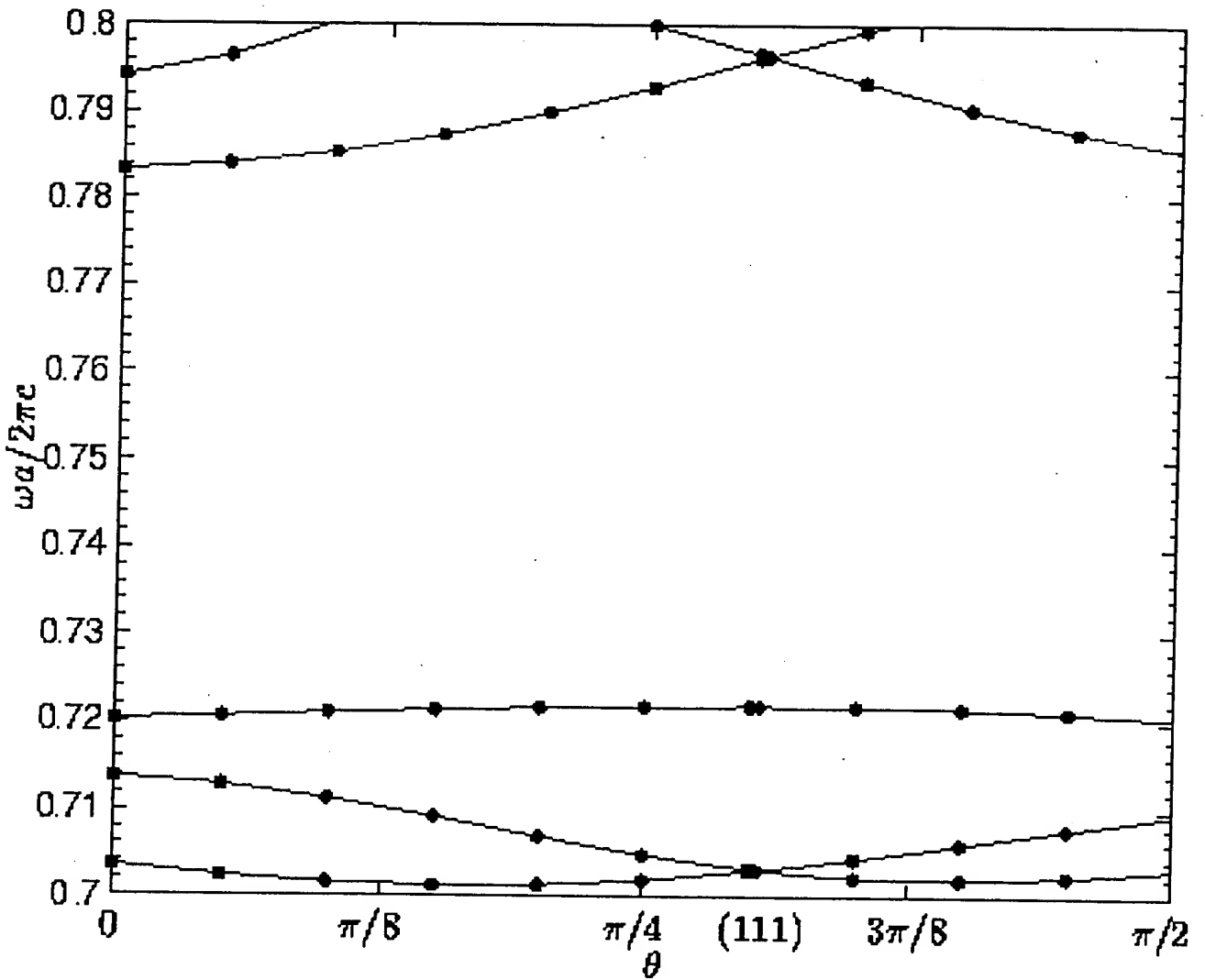


Figure 8: Variation at the X point: Bands 1-4

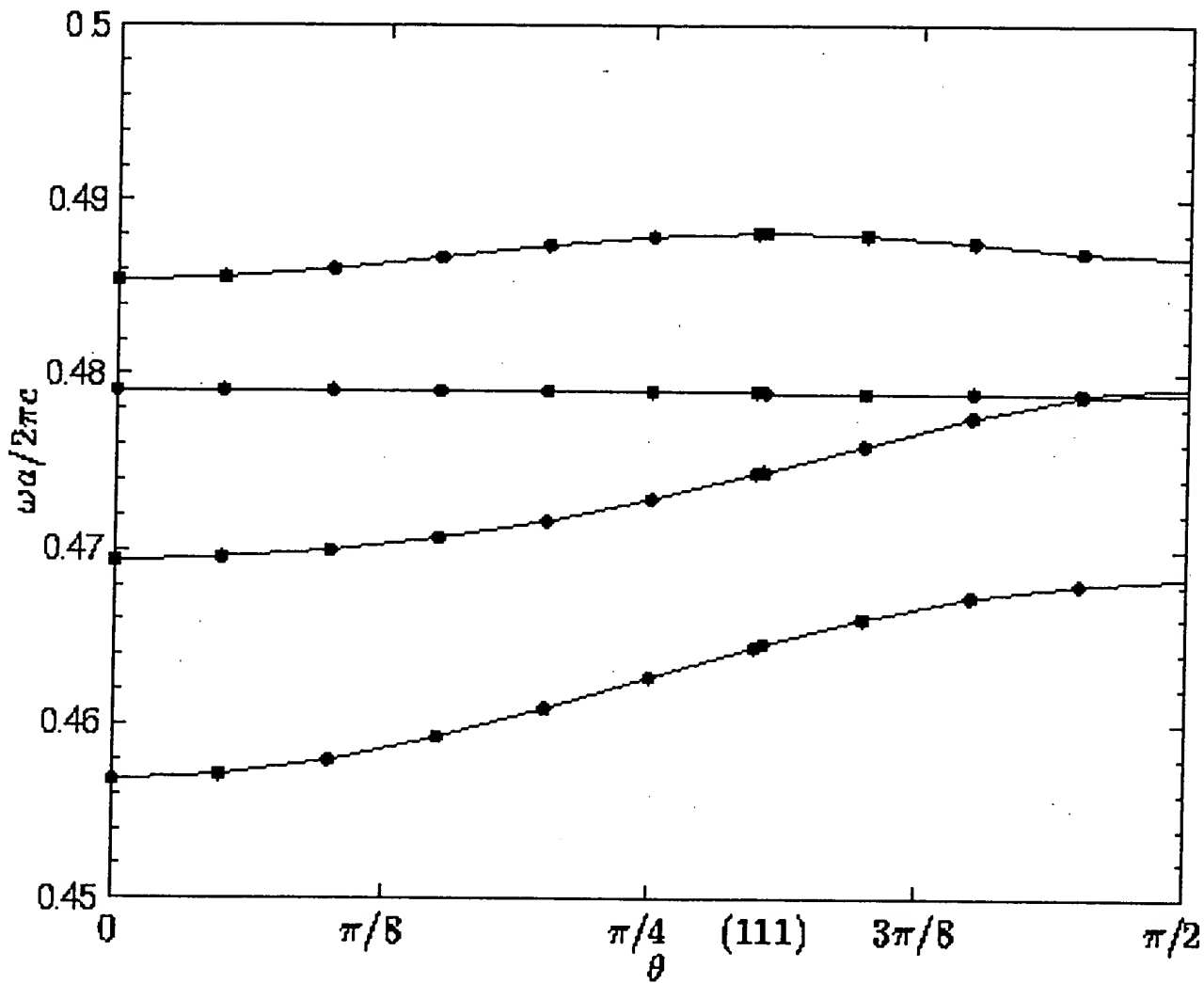
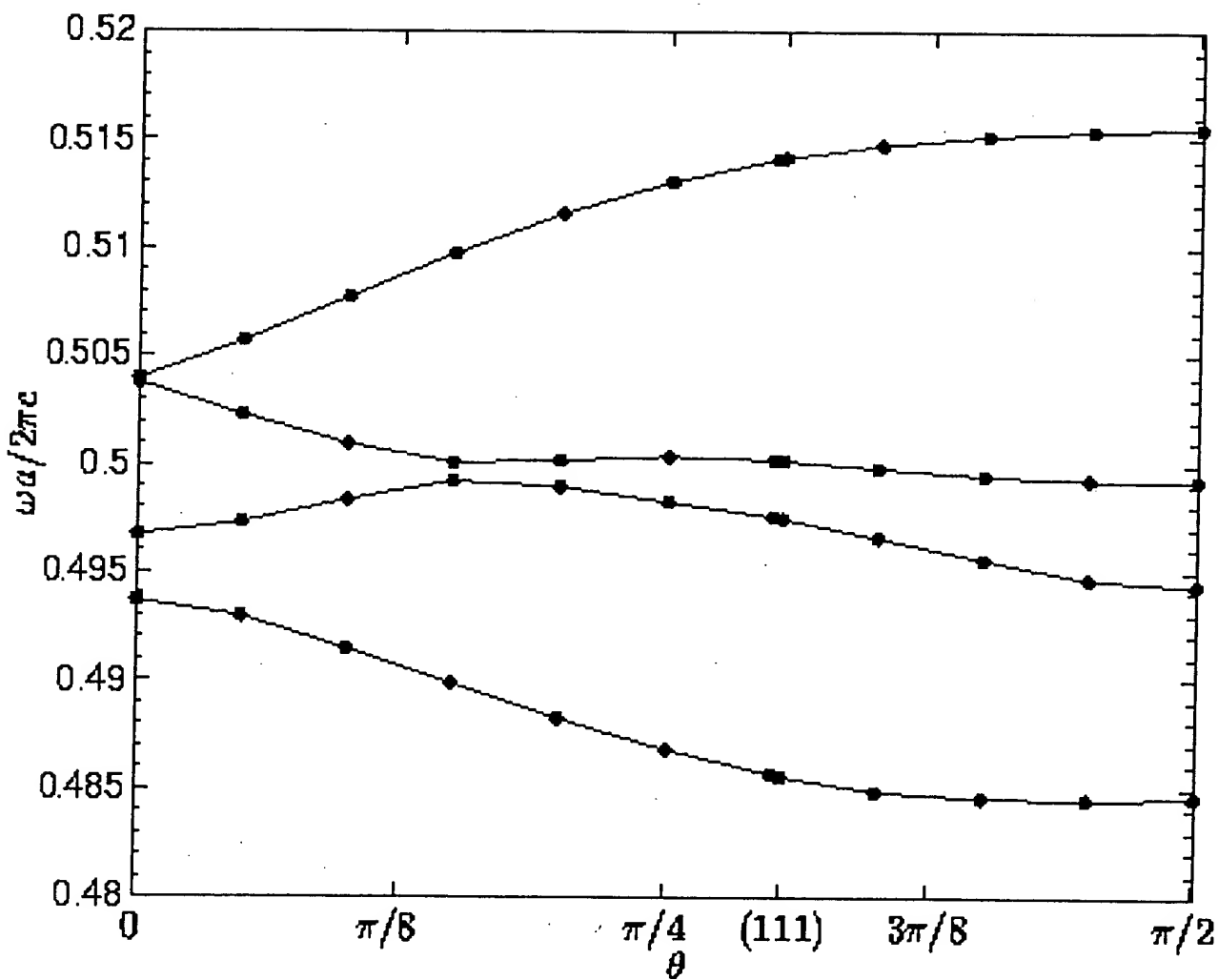




Fig 9. Variation at the W-point: Bands 1-4



09909998-072301  
108220-86660660

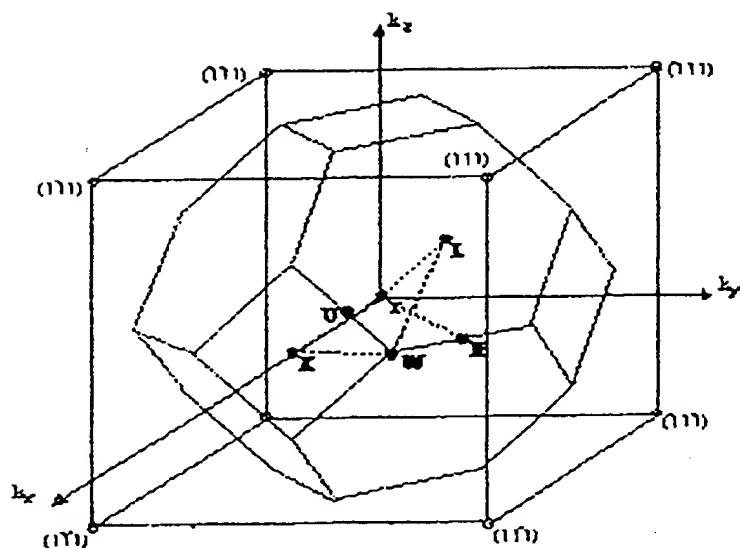


FIG. 10

09909998.072301  
10E270" 86660660

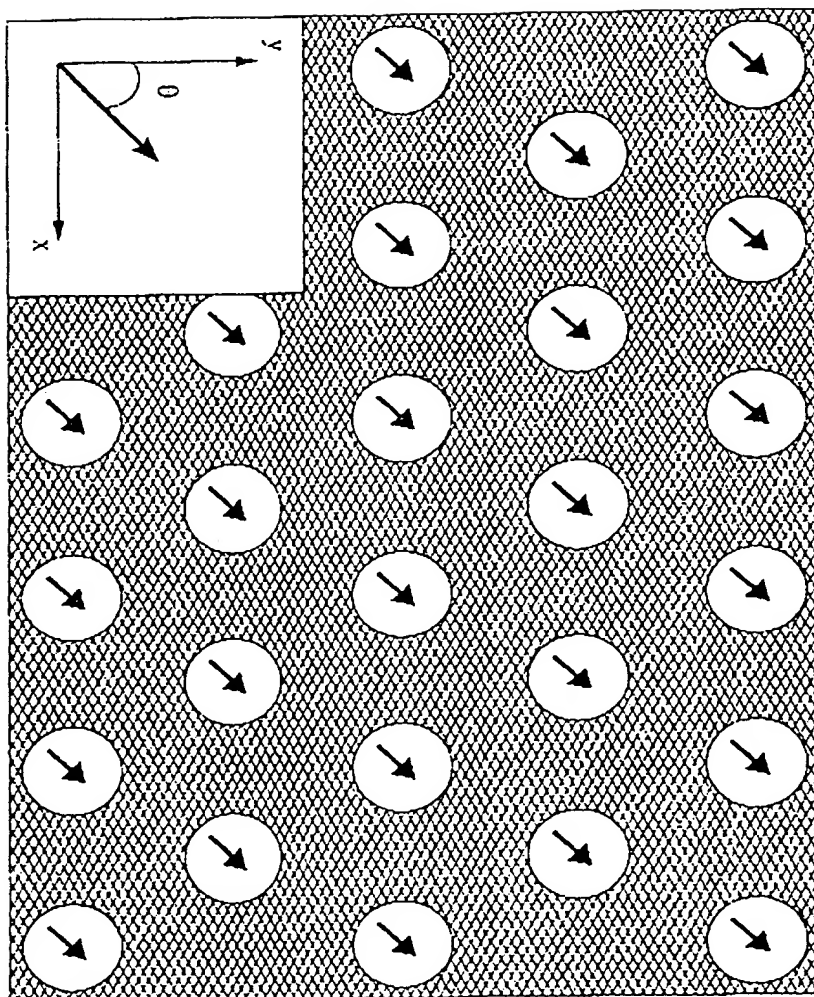


FIG. 11

TOP SECRET 85660650

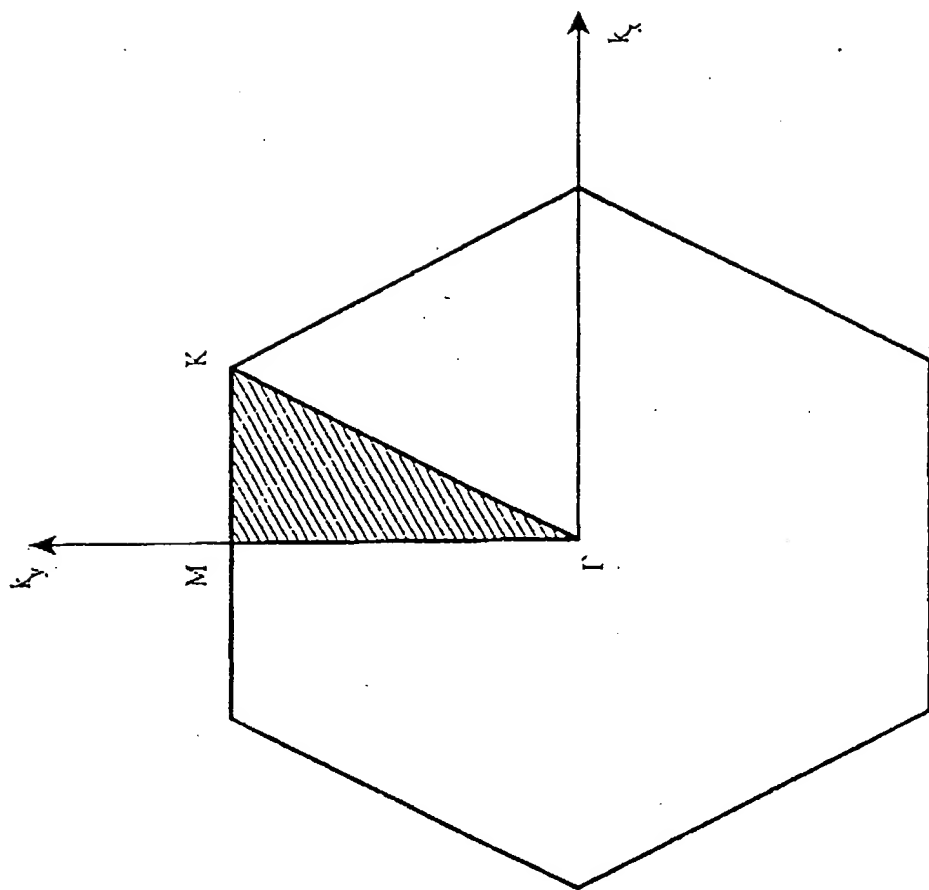


FIG. 12

F16. 13

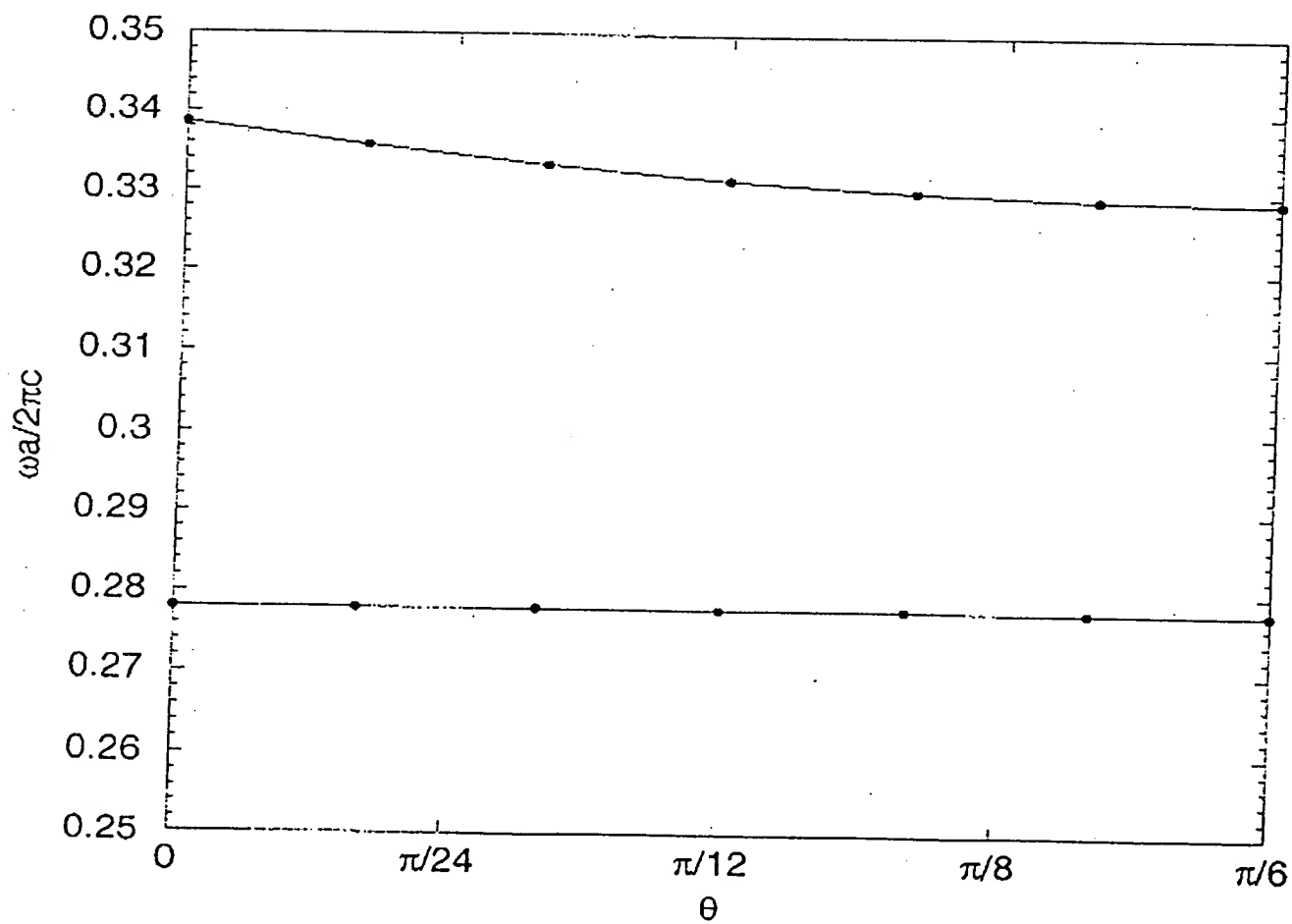


FIG. 14

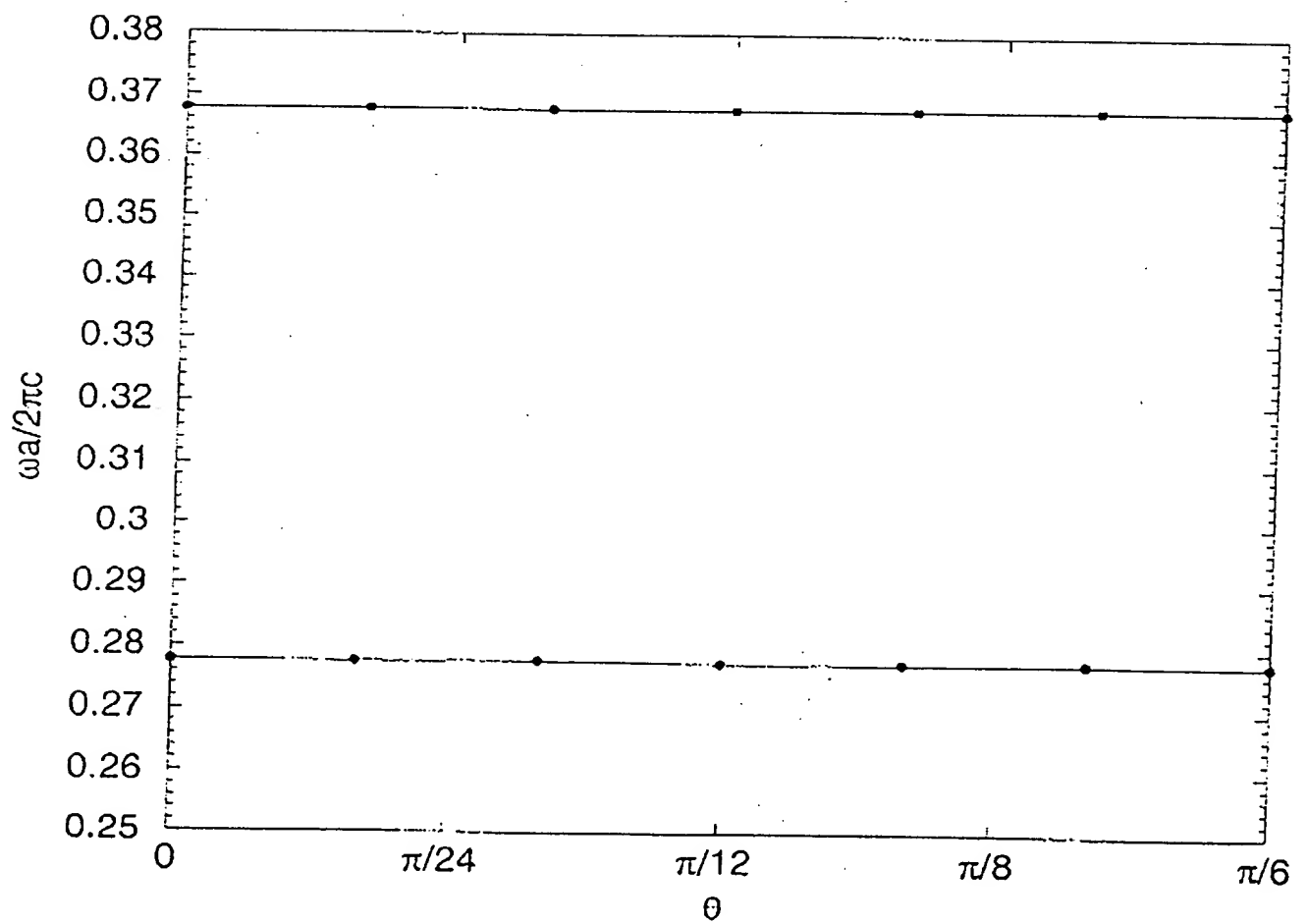


FIG. 15

10E220" 86650660

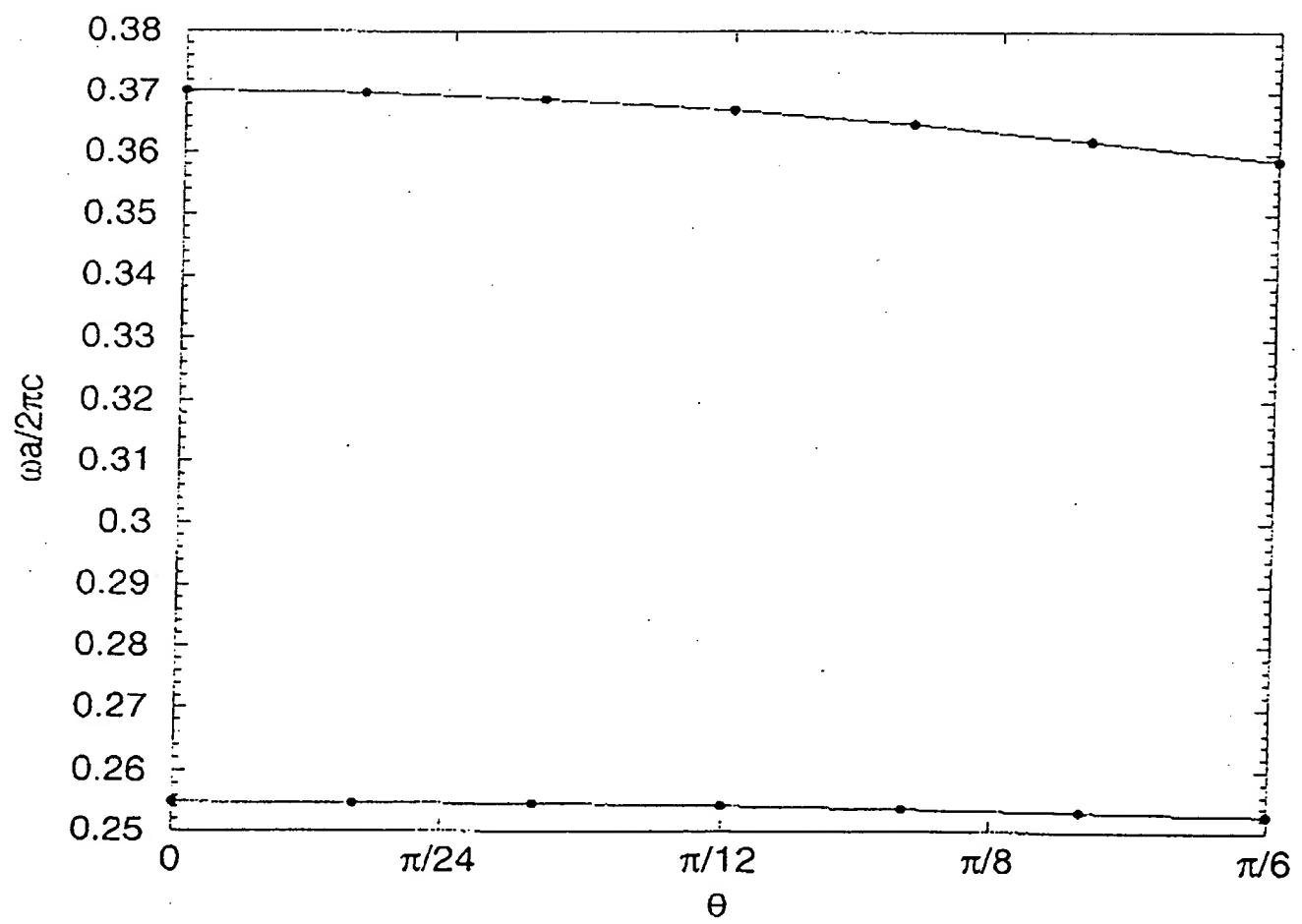
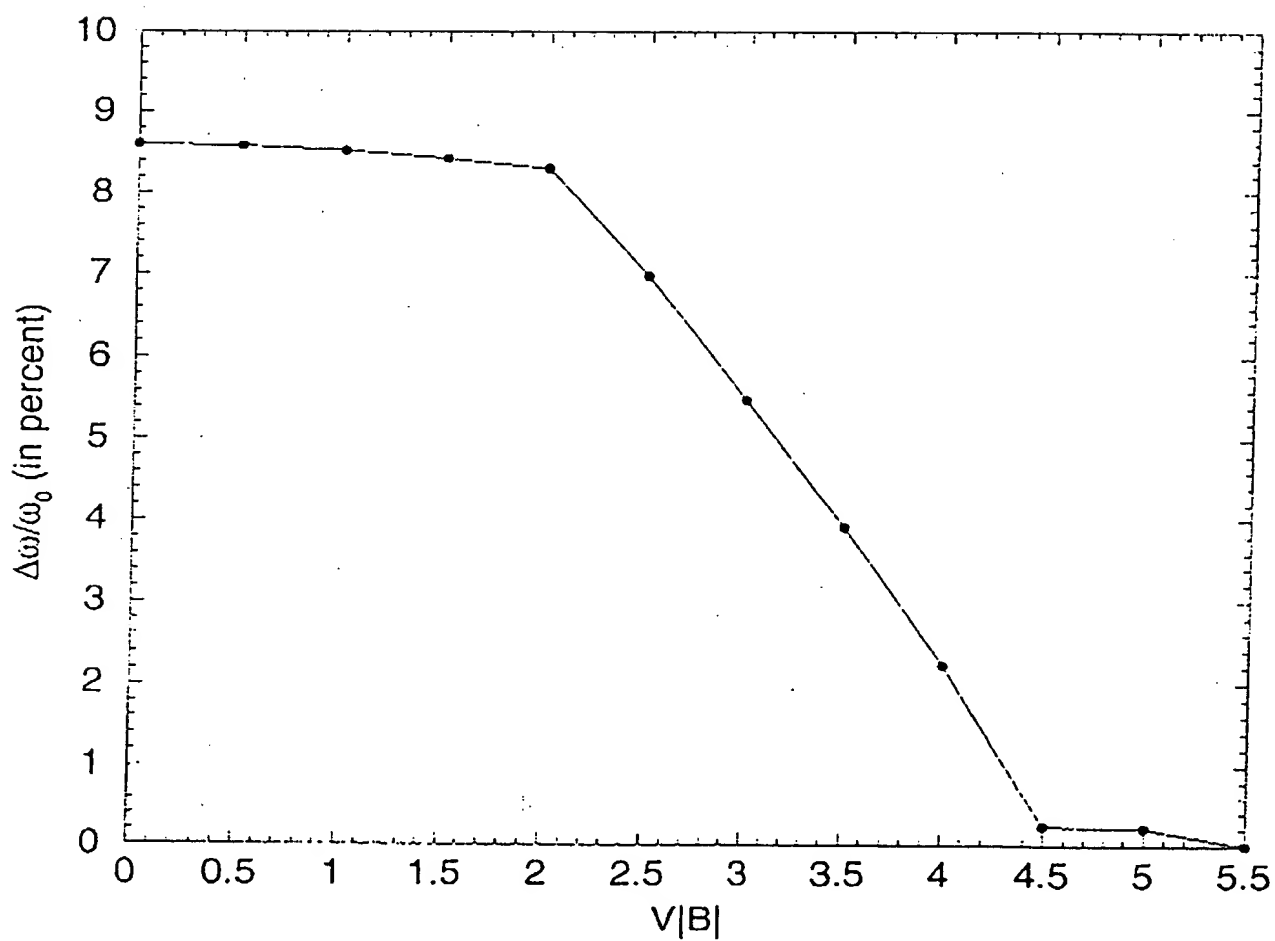


FIG. 16





F-16, 17.

